A COMPARISON OF CRYSTALLINE ROCKS FROM ILLINOIAN AND LATE WISCONSIN GLACIAL OUTWASH IN FAIRFIELD COUNTY, OHIO

A Thesis

Presented in Partial Fulfillment of the Requirements
for the Degree Bachelor of Science

by

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LIST OF MAPS

LIST OF TABLES

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I. INTRODUCTION

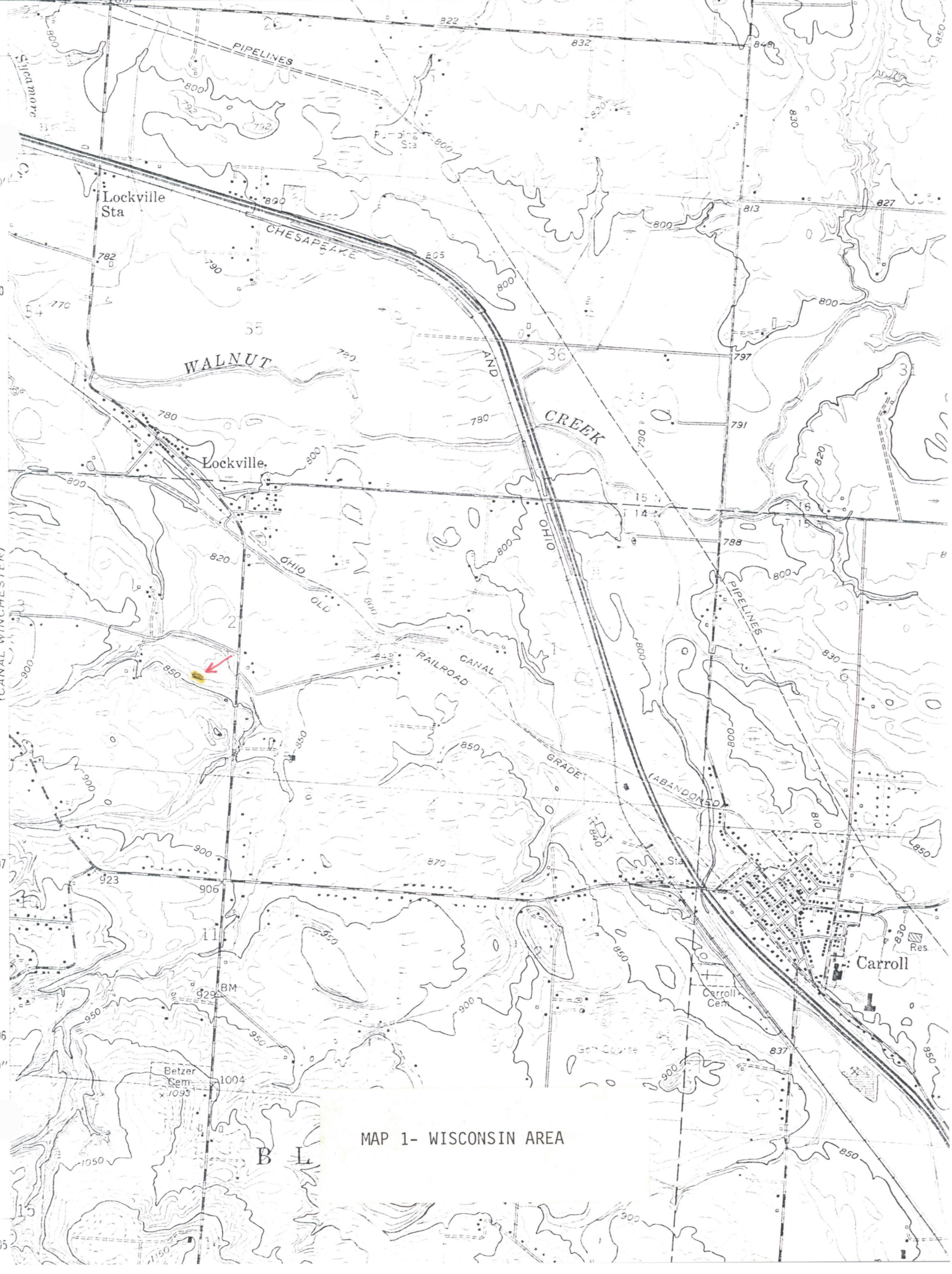
The purpose of this study is to determine whether or not there is any appreciable difference in composition between crystalline rock assemblages from the Illinoian and Late Wisconsin outwash deposits of Fairfield County, Ohio. Samples were randomly selected from one locality of each age and analyzed to determine composition. On the basis of preliminary hand specimen analysis, the samples were arranged in several representative groups. Specimens from each group were examined using thin section techniques. The samples were then grouped by basic composition into five groups. The number of specimens in each group was tabulated and a percentage was obtained. This percentage was compared to determine if the source area of the two glaciations was similar or not.

The Illinoian glaciation in Ohio occurred from about 180,000 years ago to 120,000 years ago. When the Illinoian ice bagan melting back, it left behind extensive areas of ground moraine and outwash from meltwater streams. These streams eventually filled existing stream valleys with outwash. With the onset of Early Wisconsin glaciation from 70,000 years ago to 53,000 years ago the area was covered again by ice. During glaciation and meltback, erosion removed most of the previously deposited Illinoian outwash and deposited outwash of Early Wisconsin Age. The area was then again subjected to glaciation. This was the Late Wisconsin glaciation, lasting from 23,000 years ago to 7,500 years ago. Again glaciation and meltback removed most of the previously deposited Early Wisconsin outwash and deposited outwash of Late Wisconsin Age. Meanwhile, with continued melting of the glacier, esker and kame deposits which were deposited beneath or just adjacent to the glacier were revealed. Many end moraines occurred in this glaciation because the melting took place episodically. Ground moraine of Late Wisconsin Age is present throughout the area. Illinoian deposits only occur south of the furthest extent of the Wisconsin ice. Wisconsin deposits only occur south of this boundary in drainage channels. In areas where both Wisconsin and Illinoian outwash deposits are present, they occur in distinct terrace levels with the Illinoian terraces being at a higher level than the Wisconsin because of greater infilling of the channel by Illinoian Age deposits.

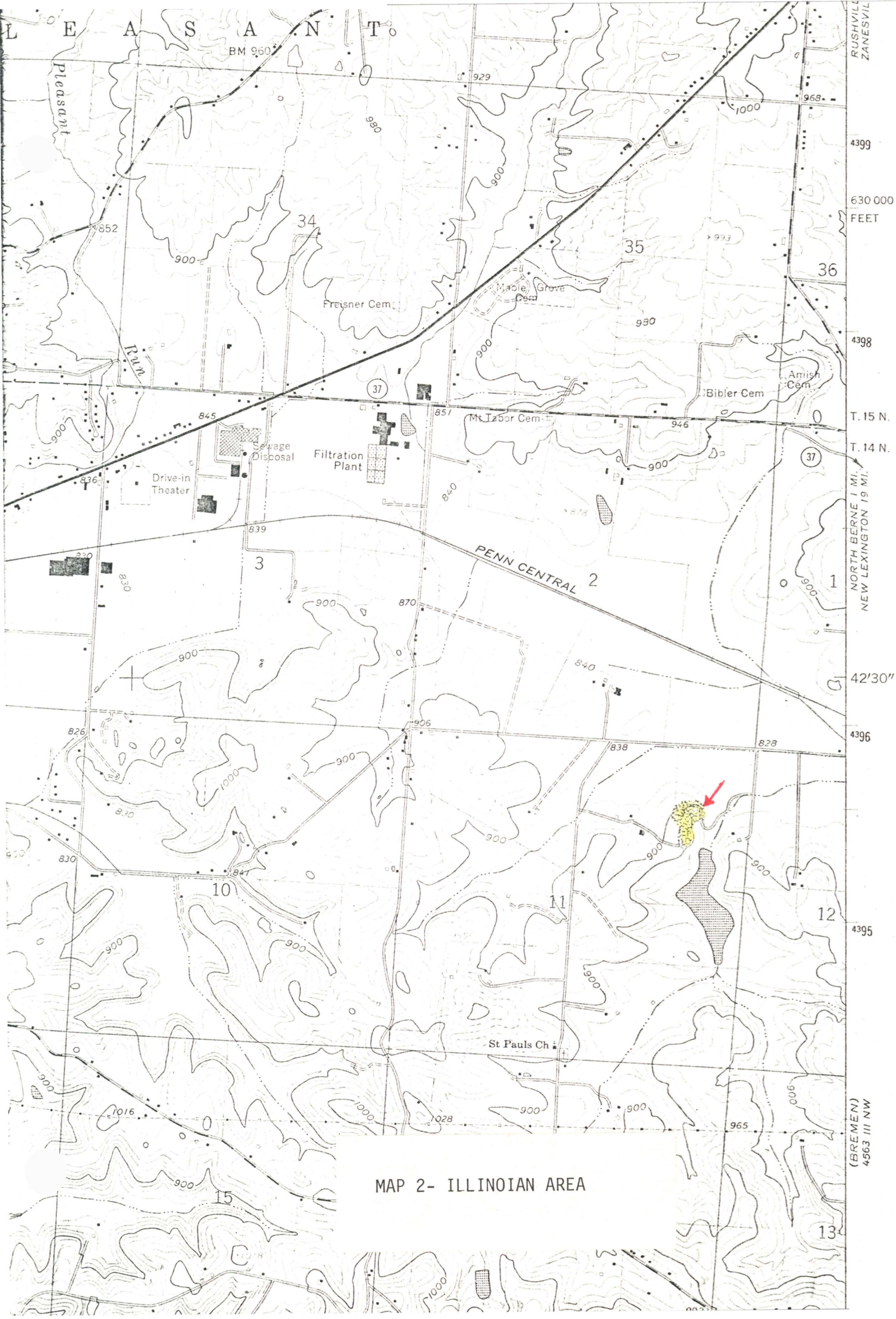
In the Late Wisconsin Carroll Kame deposits near Carroll, Ohio and the Illinoian Outwash deposits east of Lancaster there are a large number of crystalline rocks. These two areas were particularly accessible and seemed to be representative deposits of each age.

The Carroll Kame locality is about 100 yards off Hummel Road as shown on Map 1. The area has been used as a source of gravel so the hillside is cut away exposing the Kame deposit. The samples were taken from a zone about six to eighteen feet below the surface. This lower position marks the top of the talus slope at the base of the cut. All samples were, however, taken directly from the exposed bank and not from the talus.

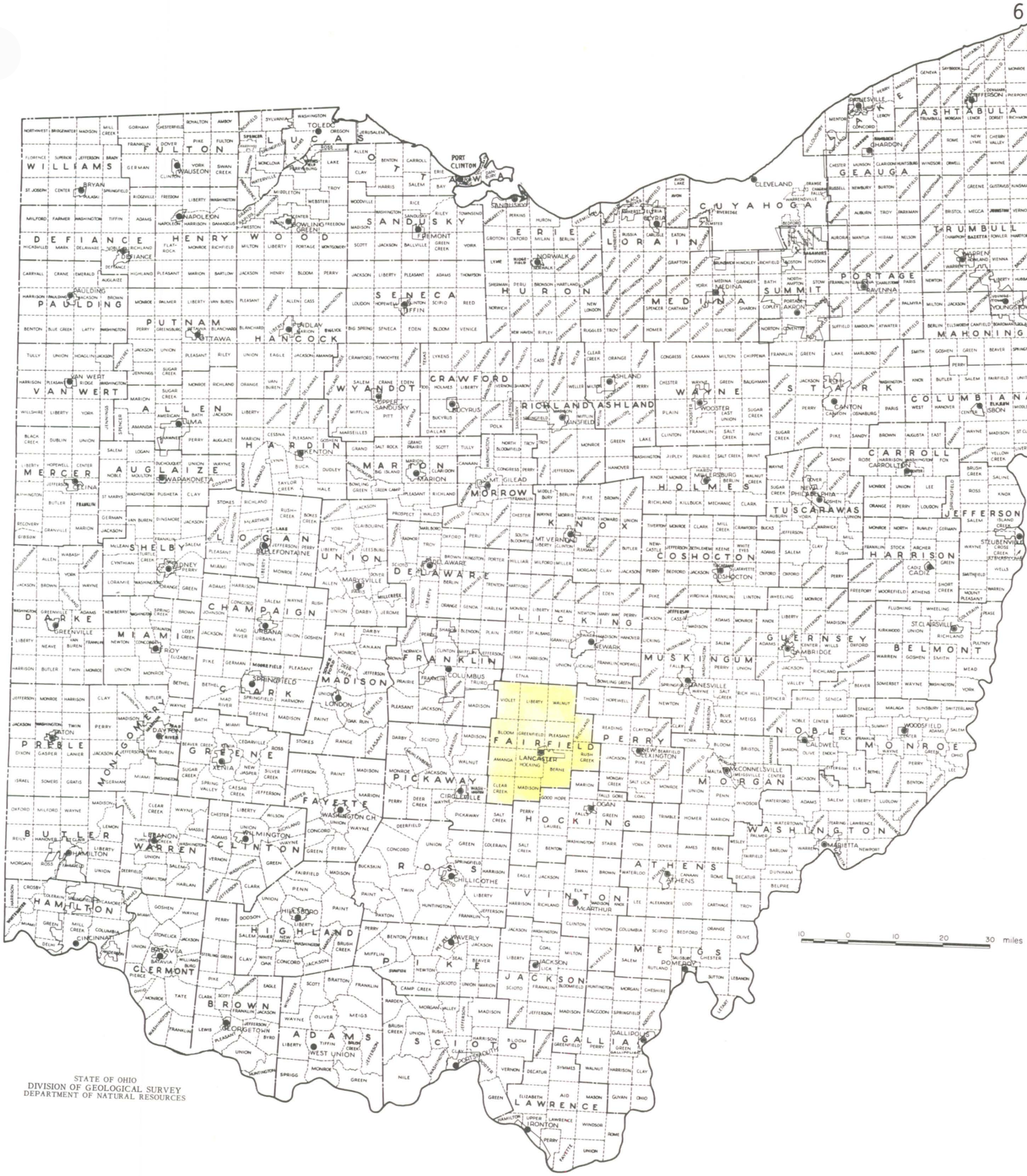
The site of the Illinoian Outwash locality (Map 2) was on top of a ridge approximately 5 miles east of Lancaster (near North Berne). The outwash material has been mined commercially in the past so an extensive portion of the hillside had already been removed. Because of this removal, there is a cliff about fifty feet high. Collection from material in place was not practical because the sediments are unconsolidated and about twenty-five feet up on the cliff face. As a result of this problem, a representative sample was collected from piles of outwash material that had recently been separated out and sorted by machine.



MAP 1- WISCONSIN AREA



MAP 2- ILLINOIAN AREA


WILLIAMS
FULTON
LUCAS
OTTAWA
DEFIANCE
HENRY
WOOD
SANDUSKY
ERIE
LORAIN
CUYAHOGA
LAKE
GEAUGA
ASHTABULA
TRUMBULL
PORTAGE
SUMMIT
MEDINA
HURON
SENECA
HANCOCK
PUTNAM
PAULDING
VAN WERT
ALLEN
HARDIN
WYANDOT
CRAWFORD
RICHLAND
ASHLAND
WAYNE
STARK
COLUMBIANA
MAHONING
MERCER
AUGLAIZE
LOGAN
UNION
MARION
MORROW
KNOX
HOLMES
TUSCARAWAS
CARROLL
JEFFERSON
HARRISON
COSHOCTON
DELAWARE
SHELBY
DARKE
MIAMI
CHAMPAIGN
CLARK
MADISON
FRANKLIN
LICKING
MUSKINGUM
GUERNSEY
BELMONT
PREBLE
MONTGOMERY
GREENE
PICKAWAY
FAIRFIELD
PERRY
MORGAN
NOBLE
MONROE
WASHINGTON
BUTLER
WARREN
CLINTON
FAYETTE
ROSS
HOCKING
ATHENS
VINTON
HAMILTON
CLERMONT
HIGHLAND
BROWN
ADAMS
PIKE
SCIOTO
JACKSON
MEIGS
GALLIA
LAWRENCE
10 0 10 20 30 miles
STATE OF OHIO
DIVISION OF GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES

MAP 3

IV. PROCEDURE

The method of sampling used in both areas was designed to obtain a more or less random sample. First, an area was established outlined by vertical range. The Wisconsin age material was collected from about a ten foot thickness of outwash that seemed to have abundant crystalline rocks. The Illinoian sample was assumed to be from a thicker zone, but as the rocks were not in place it is not possible to determine the exact thickness.

In selecting sample material several types of specimens were omitted from collection. These were specimens that were either too weathered for accurate study or too small. Rocks collected ranged in size from about an inch in diameter to about six inches in diameter. Selection was made after each specimen was examined to determine if in fact it was crystalline. Rocks of doubtful composition were also collected and then tested later to confirm type of rock.

The samples were roughly grouped together on the basis of general composition and if they were igneous or metamorphic. These generalized groups were: granitic type rocks, dioritic type rocks, metamorphics, miscellaneous rocks, and an additional group of tillite type rocks. The granitic group included granites, granodiorites, quartz monzonites and their fine grained equivalents. The dioritic group was composed of diorites, gabbros, basalts, syenites, monzonites and their fine grained equivalents. The metamorphic group included schists, gneisses and a few gradational types. The miscellaneous group includes a few monomineralic rocks and a few quartzites. The tillite group has rocks with varying amounts of lithic inclusions.

At this time two samples were selected from each of three main groups, the granites, the diorites, and the metamorphics. The tillites were not sectioned because only a limited amount of information pertinent to this study could be obtained from such an inspection. A few of the miscellaneous rocks were sectioned to determine their exact composition. The specimens sectioned were selected on the basis of suitability to sectioning methods and their general representativeness of their specific group. The sample numbers and descriptions of these specimens are listed in Table 1.

The remainder of the samples were studied, identified, and assigned to their group by hand specimen analysis. This was done by the use of hand lens and tungsten carbide etcher. These were used to describe basic physical properties of minerals present in the rocks. Table 2 lists the numbers of the specimens and totals for each specific group. This total includes sectioned specimens.

TABLE 1

THIN SECTION REPORTS

Illinoian

I-16
50% Microcline
25% Quartz
15% Biotite
9% Orthoclase
1% Accessories
Magnetite or Hematite
Comments: Preferred Orientation of quartz grains
Alteration Products: Sericite
Name: Granite

I-29
60% Plagioclase
25% Quartz
15% Microcline
5% Biotite
Accessories: Opaques
Alteration Products: Sericite, Hematite
Name: Granodiorite

I-45
60% Plagioclase
25% Quartz
10% Biotite
5% Hornblende
Alteration Products: Sericite, Chlorite
Name: Quartz Diorite

I-50
Light Bands
Plagioclase
Quartz
Dark Bands
Muscovite
Chlorite
Epidote
Alteration Products: Sericite, Chlorite
Accessories: Opaques
Name: Gneiss

I-59
70% Plagioclase
20% Epidote
10% Biotite
Accessories: Opaques
Alteration Products: Sericite
Name: Diorite

I-60
Light Bands
Quartz
Microcline
Dark Bands
Quartz
Pyroxene
Biotite
Accessories: Opaques
Name: Gneiss

Wisconsin

W-3
65% Plagioclase
19% Hornblende
15% Quartz
1% Accessories: Opaques
Alteration Products: Sericite
Name: Quartz Diorite

W-15
60% Plagioclase
30% Augite
10% Biotite
Accessories: Opaques
Alteration Products: Sericite
Name: Gabbro

W-34
45% Plagioclase
20% Microcline
20% Quartz
15% Biotite
Comments: Banding and orientation of biotite grains.
Name: Gneiss

W-42
Light Bands
Quartz
Orthoclase
Plagioclase
Dark Bands
Muscovite
Accessories: Opaques
Alteration Products: Sericite
Name: Gneiss

W-59
65% Plagioclase
15% Quartz
15% Hornblende
5% Biotite
1% Accessories: Sphene
Alteration Products: Sericite, Hematite
Name: Quartz Diorite

W-65
65% Microcline
20% Quartz
14% Biotite
1% Accessories: Opaques
Name: Granite

TABLE 2

Wisconsin

Granitic Group	Specimen #	Granite	Quartz Monzonite	Granodiorite
	W-5			X
	W-6			X
	W-20			X
32.5%	W-21		X	
	W-32	X		
	W-38	X		
	W-40		X	
	W-52	X		
	W-53			X
	W-54			X
	W-55	X		
	W-56	X		
	W-57	X		
	W-58	X		
	W-60	X		
	W-61	X		
	W-62	X		
	W-63	X		
	W-64	X		
	W-66	X		
	W-68	X		
	W-70	X		
	W-75	X		
	W-76	X		
	W-80	X		
totals	25	18	2	5

Dioritic Group	Specimen #	Diorite	Quartz Diorite	Basalt	Gabbro	Monzonite
	W-1	X				
	W-2	X				
	W-3	X				
34%	W-4		X			
	W-7				X	
	W-8			X		
	W-9			X		
	W-11	X				
	W-12	X				
	W-13				X	
	W-14					X
	W-15				X	
	W-16				X	
	W-17	X				
	W-18				X	

Dioritic Group (cont.)	Specimen #	Diorite	Quartz Diorite	Basalt	Gabbro	Monzonite
	W-22				X	
	W-27					X
	W-33	X				
	W-43			X		
	W-50			X		
	W-59		X			
	W-67					X
	W-69					X
	W-73					X
	W-77	X				
	W-78			X		
	W-79			X		
totals	27	8	2	7	5	5

Metamorphic Group	Specimen #	Gneiss	Schist
	W-25	X	
	W-26	X	
	W-28		X
	W-29	X	
19%	W-30	X	
	W-31	X	
	W-34	X	
	W-35	X	
	W-36	X	
	W-37	X	
	W-42	X	
	W-44	X	
	W-47	X	
	W-48	X	
	W-49	X	
total	15	14	1

		Tillite
Tillite	W-23	X
2%	W-24	X
total	2	2

		Quartzite	Unknown
	W-10	X	
Miscellaneous	W-19	X	
	W-39		X
	W-41	X	
	W-45		X
	W-46	X	
	W-51		X
12.5%	W-71	X	
	W-72	X	
	W-74	X	
totals	10	7	3

Illinoian

Granitic Group	Specimen #	Granite	Granodiorite	Quartz Monzonite
	I-1	X		
	I-4	X		
35%	I-5	X		
	I-6	X		
	I-7	X		
	I-8	X		
	I-9	X		
	I-10	X		
	I-11	X		
	I-12	X		
	I-13	X		
	I-14	X		
	I-15	X		
	I-16	X		
	I-17	X		
	I-18	X		
	I-19	X		
	I-20	X		
	I-21	X		
	I-22	X		
	I-23	X		
	I-24	X		
	I-25	X		
	I-29		X	
	I-48	X		
	I-51	X		
	I-52			X
	I-65	X		
	I-75			X
	I-77	X		
total	30	27	1	2

Dioritic Group	Specimen #	Syenite	Monzonite	Diorite	Quartz Diorite	Rhyodacite	Gabbro	Basalt
	I-2	X						
	I-3		X					
	I-26			X				
	I-27			X				
30%	I-28			X				
	I-31							X
	I-32							X
	I-33			X				
	I-34			X				
	I-35					X		
	I-39							X
	I-40							X
	I-41							X
	I-43			X				
	I-44			X				
	I-45				X			
	I-47						X	

Dioritic Group (cont.)	Specimen #	Syenite	Monzonite	Diorite	Quartz Diorite	Rhyodacite	Gabbro	Basalt
	I-59			X				
	I-62	X						
	I-66							X
	I-67							X
	I-68							X
	I-70							X
	I-71							X
	I-72							X
	I-73						X	
totals	26	2	1	8	1	1	2	11

Metamorphic Group	Specimen #	Gneiss	Schist
	I-42	X	
	I-49	X	
	I-50	X	
	I-54	X	
14%	I-55	X	
	I-56	X	
	I-57	X	
	I-58	X	
	I-60	X	
	I-61	X	
	I-63	X	
	I-84		X
total	12	11	1

Tillite	Specimen #	Tillite
1%	I-74	X
total	1	1

Miscellaneous	Specimen #	Quartzite	Other	Unknown
	I-30	X		
	I-36	X		
	I-37	X		
20%	I-46			X
	I-53	X		
	I-61			X
	I-69		X	
	I-76	X		
	I-78		X	
	I-79		X	
	I-80	X		
	I-81			X
	I-82		X	

Miscellaneous (cont.)	Specimen #	Quartzite	Other	Unknown
	I-83		X	
	I-85			X
	I-86			X
	I-87			X
totals	17	6	5	6

V. CONCLUSION

The compositions of the assemblages of crystalline rocks from the Illinoian and Wisconsin outwashes are basically the same. The percentages representing the relative abundance of the different groups of rocks are listed in Table 2. Although the similarity of composition between the two groups seems to indicate they came from the same area, there are several other equally viable reasons for this similarity. The first being the size and extent of the Canadian Shield area. Glaciers moving from different source areas may have passed over different areas of the shield and received rocks of similar composition. Another possible reason would be the method of study. Perhaps if the samples were all studied under thin section and grouped into major catagories, a more conclusive outcome may have been reached. Another factor contributing to error would be the sampling method itself. Many limestone pebbles resembled fine grained crystalline rocks, so it is possible in rough field identification that some fine grained crystallines were mistaken for limestone and not collected, thus affecting the final percentages in each area. As a final conclusion, the results of this investigation still leave open the possibility that both glaciations originated in the same area, but a more indepth study would have to be performed to determine anything more conclusive.

VI. BIBLIOGRAPHY

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